

UPSCALING THE POTENTIAL OF ENERGY COMMUNITIES TO COUNTRY-LEVEL

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Motivation

As decentralized generation in our energy system increases, local energy communities become more and more prevalent. The participants are called prosumers and consume and/or produce electricity from renewable sources. The locally generated electricity can be shared or traded, e.g., trading directly between the participants, so-called peer-to-peer trading. Within the H2020 project openENTRANCE [3], a case study evaluates the potential of energy communities with peer-to-peer trading in Austria and four other European countries. A method is proposed to upscaling the energy community potential to country level and results for Austria and one other reference country are to be presented here.

Methodology

The open-source optimization model FRESH:COM (Fair energy sharing in local communities), see [1] and [2], is applied to local energy communities with photovoltaic (PV) including battery energy storage systems (BESS). The objective function maximizes the so-called community welfare, *CW*, by minimizing grid purchases and optimally allocating electricity from local PV generation between the participants (prosumers), considering their individual willingness-to-pay, *wtp*. The output of the model includes hourly time series of electricity traded between participants, transactions with the grid, and BESS operation, as well as revenue streams of all actors involved. In the next step, energy communities within different settlement patterns are defined:

- Urban area,
- Suburban area,
- Rural area,

which are characterized by different demand for electricity, available roof areas for PV systems, settlement density and demography. The share of each settlement pattern per region is evaluated using available statistics on population and building types. With this knowledge, the number of energy communities and their type is determined per region, and sub-sequentially, the potential of a whole country is derived.

Results and discussion

The results of the present work include the number of energy communities and prosumers involved, the PV capacities (in MW) utilized in energy communities, as well as the savings in costs and CO₂-emissions due to collective self-consumption and peer-to-peer trading. These results are presented for Austria and one other country in Europe. After evaluation of the remaining reference countries, the results will be used to qualitatively upscale the energy community potential to European level.

Referenzen

- [1] T. Perger (2021), GitHub Repository FRESH:COM, <https://github.com/tperger/fresh-com>
- [2] T. Perger, L. Wachter, A. Fleischhacker, H. Auer, PV sharing in local communities: Peer-to-peer trading under consideration of the prosumers' willingness-to-pay, In: Sustainable Cities and Society (2021), DOI: <https://doi.org/10.1016/j.scs.2020.102634>
- [3] openENTRANCE project: <https://openentrance.eu/>

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